SAFEGUARDS INFORMATION

March 3, 2005

Mr. H. B. Barron
Executive Vice President
Nuclear Generation
Duke Energy Corporation
526 South Church Street
Charlotte, North Carolina 28202

SUBJECT: CATAWBA NUCLEAR STATION, UNITS 1 AND 2 RE: EXEMPTIONS FROM TITLE 10 OF THE CODE OF FEDERAL REGULATIONS FOR THE USE OF MIXED OXIDE (MOX) FUEL LEAD TEST ASSEMBLIES (TAC NOS. MB7863 AND MB7864)

Dear Mr. Barron:

The Nuclear Regulatory Commission has approved the enclosed Exemptions from the requirements of (1) Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50.46(a)(1)(i) and Appendix K to 10 CFR Part 50 with respect to the use of M5™ (M5) fuel rod cladding; (2) 10 CFR 50.46(a)(1)(i) and Appendix K to 10 CFR Part 50 with respect to the use of MOX fuel; and (3) from certain physical security requirements of 10 CFR Parts 11 and 73 related to the use of MOX fuel, for Catawba Nuclear Station, Units 1 and 2. This action is in response to your letter dated February 27, 2003, as supplemented by letters dated September 15, September 23, October 1 (two letters), October 3 (two letters), November 3, November 4, December 10, 2003, and February 2 (two letters), March 1 (three letters), March 9 (two letters), March 16 (two letters), March 26, March 31, April 13, April 16, May 13, and June 17, August 31, September 20, October 4, October 29 and December 10, 2004. Your request for a similar exemption from the requirements of 10 CFR 50.44(a) with respect to the use of M5 fuel rod cladding is not being granted since 10 CFR 50.44 has been changed and an exemption from the requirements is no longer necessary.

NOTICE: Enclosure 2 contains Safeguards Information. Upon separation from Enclosure 2, this letter and Enclosure 1 are DECONTROLLED.

SAFEGUARDS INFORMATION

A copy of the Exemptions is enclosed. A more detailed version of the Exemptions is provided in Enclosure 2. Enclosure 2 is not provided to the public since it contains safeguards information related to the Exemptions from Parts 11 and 73. The publically available Exemptions in Enclosure 1 have been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Robert E. Martin, Sr. Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-413 and 50-414

Enclosures: 1. Exemption (Non-Safeguards)
2. Exemption (Safeguards)

cc w/encl 1 only: See next page

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Sincerely,

/RA/
Robert E. Martin, Senior Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-413 and 50-414

Enclosure: 1. Exemption (Non-Safeguards)
2. Exemption (Safeguards)

cc w/encl 1 only: See next page

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NUCLEAR REGULATORY COMMISSION

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NORTH CAROLINA ELECTRIC MEMBERSHIP CORPORATION

SALUDA RIVER ELECTRIC COOPERATIVE, INC.

NORTH CAROLINA MUNICIPAL POWER AGENCY NO. 1

PIEDMONT MUNICIPAL POWER AGENCY

CATAWBA NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413 AND 50-414

EXEMPTION

1.0 BACKGROUND

Duke Energy Corporation, (the licensee) is the holder of Facility Operating License Nos. NPF-35 and NPF-52, which authorize operation of the Catawba Nuclear Station (Catawba), Units 1 and 2. The licenses provide, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of two pressurized water reactors located in York County, South Carolina.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.46, "Acceptance criteria for emergency core cooling systems [ECCS] for light-water nuclear power reactors," and Appendix K, "ECCS Evaluation Models," identify requirements for calculating ECCS performance for reactors containing fuel with Zircaloy or ZIRLO cladding, and uranium oxide fuel. Part 11 of 10 CFR, "Criteria and Procedures for Determining Eligibility for Access to or Control Over Special Nuclear Material [SNM]," and 10 CFR Part 73, "Physical Protection of Plants and Materials," identify requirements that are usually applicable to fuel fabrication facilities for the protection of formula quantities of strategic special nuclear material (SSNM).

By letter dated February 27, 2003, as supplemented by letters dated September 15, September 23, October 1 (two letters), October 3 (two letters), November 3, November 4, December 10, 2003, and February 2 (two letters), March 1 (three letters), March 9 (two letters), March 16 (two letters), March 26, March 31, April 13, April 16, May 13, June 17, August 31, September 20, October 4, October 29, and December 10, 2004, the licensee requested exemptions from 10 CFR 50.46, Appendix K to 10 CFR Part 50, and from certain physical security requirements of 10 CFR 11.11(a)(1) - (a)(2), 11.11(b), 10 CFR 73.45(d)(1)(iv), 73.46 (c)(1), 73.46(h)(3), 73.46(b)(3) - (b)(12), 73.46(d)(9), and 73.46(e)(3). These exemptions would allow Catawba to operate with up to four lead test assemblies (LTAs) that would use M5^{TM} (M5) type fuel rod cladding and fuel rods containing mixed uranium and plutonium (Pu) oxide (MOX) fuel in non-limiting core locations. The purpose of the LTA effort at Catawba is to confirm that the MOX fuel performs as expected in a nuclear power reactor. This effort is part of the Department of Energy (DOE) Surplus Plutonium Disposition Project, an ongoing Pu

disposition program of the United States and the Russian Federation. The goal of this non-proliferation program is to dispose of surplus Pu from nuclear weapons by converting the material into MOX fuel and using that fuel in nuclear power reactors.

3.0 DISCUSSION OF PART 50 EXEMPTIONS FOR M5 CLADDING AND MOX FUEL

Pursuant to 10 CFR 50.12, "Specific exemptions," the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50, when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. Under Section 50.12(a)(2), special circumstances include, among other things, when the application of the regulation would not serve, or is not necessary to achieve, the underlying purpose of the rule.

The underlying purpose of 10 CFR 50.46, and Appendix K to 10 CFR Part 50, is to establish requirements for the calculation of ECCS performance, and acceptance criteria for that performance, in order to assure that the ECCS functions to transfer heat from the reactor core following a loss-of-coolant accident (LOCA), such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented, and (2) clad metal-water reaction is limited to specified amounts.

Cladding Exemption

The regulation in 10 CFR 50.46 contains acceptance criteria for ECCSs for reactors fueled with Zircaloy or ZIRLO cladding. In addition, paragraph I.A.5, "Metal-Water Reaction Rate," of Appendix K to 10 CFR Part 50, requires that the Baker-Just equation be used to predict the rates of energy release, hydrogen generation, and cladding oxidation from the metal-water reaction. However, the Baker-Just equation assumes the use of Zircaloy clad fuel. Thus, an exemption from the requirements of 10 CFR 50.46, and Appendix K to 10 CFR Part 50 is needed for Duke to irradiate the LTAs that include fuel rods clad with M5 material.

The licensee has performed evaluations of the fuel rod mechanical design using approved methods. No new or altered design limits need to be applied, nor are any required for this program for the purposes of 10 CFR Part 50, Appendix A, “General Design Criteria for Nuclear Power Plants,” Criterion 10, “Reactor Design.” The licensee has evaluated the areas of the mechanical design that could potentially be impacted by M5 cladding, namely, material properties, corrosion, internal rod pressures, fatigue, growth, rod bow, and thermal creep. The material properties of M5 cladding are similar in many respects to those of approved Zircaloy type cladding; those properties that differ have been evaluated by the NRC staff and found to be acceptable. The licensee determined that the M5 cladding had better corrosion performance than the Zircaloy-4 cladding, and compatible thermal creep. On this basis, the NRC staff finds that the use of M5 cladding for the mechanical design of the LTAs is acceptable, subject to appropriate implementation of the NRC staff-approved analysis methodology.

The licensee has performed evaluations of the nuclear design for a core using MOX LTAs. The licensee states that the MOX LTAs will not be positioned in the highest power locations. The licensee determined that the MOX LTA design features will not have a significant impact on the overall core nuclear design. In accordance with approved core reload analysis methodology, the licensee will confirm this conclusion for each reload. M5 cladding is very similar to Zircaloy-4 materials in chemical composition and neutronic properties; differences in these properties have previously been evaluated by the NRC staff. Approved licensee reload methodologies can be used to model the LTAs since the features of the LTAs do not challenge the validity of the standard methodologies. Given the limited number of LTAs to be installed, the installation in non-limiting locations, and the results of analyses using approved methodology, the NRC staff concludes that the LTA core nuclear design is acceptable for use at Catawba.

The licensee has performed evaluations of the core thermal-hydraulic design using approved methods. The design analyses covered the MOX LTA impact on the resident fuel (fuel in the core other than of the MOX design), including departure from nucleate boiling, pressure drop, assembly lift, and lateral flow. The results show that the resident fuel analyses will bound the MOX LTA performance. Thus, the licensee assures that the thermal-hydraulic design of a reactor core containing the resident Westinghouse fuel designs and the MOX LTA design will meet applicable requirements. The licensee has shown that MOX fuel heat transfer properties are very similar to low-enriched uranium (LEU) fuel properties and are capable of being modeled with currently approved codes. The NRC staff has confirmed that the licensee has evaluated the nuclear heat transfer properties and cooling requirements for the four MOX LTAs using approved codes and concludes that sufficient capability exists at Catawba to provide adequate core cooling. Based on the approved methodology and conservative analyses, the NRC staff concludes that the LTA thermal-hydraulic design has been adequately evaluated and is acceptable.

The licensee has performed a LOCA safety analysis using the approved methodology for LTAs with M5 cladding. Section 50.46 identifies acceptance criteria for ECCS performance at nuclear power plants. The material properties of M5 cladding are very similar to those of Zircaloy-4 materials. Because the current analyses are done with material properties that approximate Zircaloy-4 properties, the current ECCS analysis remains applicable and unchanged for the LTAs. Therefore, the NRC staff concludes that the ECCS performance at Catawba will not be adversely affected by the insertion of MOX LTAs. As such, the licensee has achieved the underlying purpose of 10 CFR 50.46. Therefore, special circumstances exist to grant an exemption from 10 CFR 50.46 to allow the use of M5 cladding.

Paragraph I.A.5 of Appendix K to 10 CFR Part 50 states that the rates of energy release, hydrogen generation, and cladding oxidation from the metal-water reaction shall be

calculated using the Baker-Just equation. Since the Baker-Just equation assumes the use of Zircaloy-4 clad fuel, strict application of the rule would not permit use of the equation with M5 cladding for determining acceptable fuel performance. The underlying intent of paragraph I.A.5 of Appendix K to 10 CFR Part 50, however, is to ensure that analysis of fuel response to LOCAs is conservatively calculated. As previously evaluated by the NRC staff in its approval of the M5 topical report, the application of the Baker-Just equation in the analysis of M5 clad fuel will conservatively bound all post-LOCA scenarios. Thus, the underlying purpose of the rule will be met. Therefore, special circumstances exist to grant an exemption from Appendix K to 10 CFR Part 50 that would allow the licensee to apply the Baker-Just equation to M5 cladding.

The NRC staff examined the licensee's rationale to support the exemption request and, for the reasons set forth above, concludes that MOX LTAs using M5 cladding will meet the underlying purpose of 10 CFR 50.46 and Appendix K to 10 CFR Part 50. Further, the NRC staff has determined that the use of M5 cladding will have no significant effect on current assessments of a metal-water reaction, and that the mechanical design of the LTAs would perform satisfactorily. Therefore, ECCS performance will not be adversely affected and complete application of 10 CFR 50.46 and Appendix K to 10 CFR Part 50 is not necessary to achieve the underlying purpose. Based upon the considerations above, the NRC staff concludes that, pursuant to 10 CFR 50.12(a)(2), the granting of an exemption to allow the use of M5 cladding is acceptable.

Fuel Exemption

With respect to the use of MOX fuel, the regulation in 10 CFR 50.46(a)(1)(i) contains acceptance criteria for ECCSs for reactors "fueled with uranium oxide pellets." In addition, Appendix K to 10 CFR Part 50 contains several references, including paragraph I.A.1, "The Initial Stored Energy in the Fuel," that assume that only uranium dioxide fuel pellets are being

used. Thus, an exemption from the requirements of 10 CFR 50.46(a)(1)(i) and Appendix K to 10 CFR Part 50 is needed for the licensee to irradiate the LTAs that include fuel rods containing MOX fuel pellets. The underlying purpose of 10 CFR 50.46 and Appendix K to 10 CFR Part 50, paragraph I.A.1, is to establish acceptance criteria for ECCS performance and to ensure that the evaluation model contains provisions for conservatively assessing the amount of stored heat in the fuel at the onset of a postulated LOCA by adequately modeling the thermal conductivity of the fuel material and the fuel-to-cladding gap conductance. The thermal and material properties of MOX fuel have been evaluated using NRC staff-approved methods. The licensee has demonstrated that the MOX fuel properties are very similar to those of LEU fuel such that the differences in the Catawba ECCS performance arising from the MOX thermal and material properties are negligible. Therefore, the underlying purposes of Section 50.46 and paragraph I.A.1 of Appendix K to 10 CFR Part 50 are achieved with the use of MOX fuel.

The licensee states that for each reload, it will perform reload analyses to confirm adequate ECCS performance, and show that the LTAs do not have a significant impact upon the analysis at Catawba. Because the LTAs contribute to the ECCS requirements in a very minor way, the current analyses will remain bounding for them. The MOX LTAs will be placed in core locations that will not experience the most limiting power peaking during any operating cycle. In each reload analysis, the licensee will verify that the peak cladding temperature (PCT) of the MOX LTAs is not the limiting PCT. Using the Baker-Just equation, the licensee will confirm that the local cladding oxidation of the LTAs will be conservatively predicted. In addition, the licensee will confirm that the maximum hydrogen generation will be unchanged with the inclusion of the LTAs. Therefore, a coolable geometry will be maintained following a LOCA. The MOX LTAs meet the same design requirements as the resident fuel for Catawba. No safety limits or setpoints have been altered as a result of the use of the LTAs. On these bases, the NRC staff finds that the complete application of 10 CFR 50.46 and Appendix K to

10 CFR Part 50 for MOX fuel is not necessary to achieve the underlying purpose of the rule. Accordingly, the NRC staff concludes that it is acceptable to grant an exemption from the requirements of 10 CFR 50.46, and Appendix K to 10 CFR Part 50 for LTAs using MOX fuel at Catawba.

4.0 CONCLUSION FOR PART 50 EXEMPTIONS FOR M5 CLADDING AND MOX FUEL

For the reasons set forth above, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances, as described above, are present. Therefore, the Commission hereby grants Duke Energy Corporation an exemption from the requirements of 10 CFR 50.46(a)(1)(i), and Appendix K to 10 CFR Part 50, with respect to the use of M5 cladding and MOX fuel at Catawba.

5.0 DISCUSSION OF PART 11 AND PART 73 EXEMPTIONS

Pursuant to 10 CFR 11.9, “Specific exemptions,” the Commission may, upon application by any interested party, grant exemptions from the requirements of 10 CFR Part 11, “Criteria and Procedures for Determining Eligibility for Access to or Control Over Special Nuclear Material,” when the exemptions are authorized by law and will not constitute an undue risk to the common defense and security. Pursuant to 10 CFR 73.5, “Specific exemptions,” the Commission may, upon application by any interested person or on its own initiative, grant exemptions from the requirements of 10 CFR Part 73, “Physical Protection of Plants and Materials,” when the exemptions are authorized by law and will not endanger life or property or the common defense and security, and are otherwise in the public interest.

Duke Energy has requested relief from certain regulations in 10 CFR Part 11 and 10 CFR Part 73. The licensee request for exemptions from Part 11 was evaluated against the

standard specified in 10 CFR 11.9, while the request for exemptions from Part 73 was evaluated against the standard specified in 10 CFR 73.5.

The NRC staff reviewed the proposed exemptions using the information provided in the Duke Energy Corporation license amendment request; Revision 16 of the *Duke Power Company Nuclear Security and Contingency Plan* (Physical Security Plan (PSP)), Section 13.3; and the Duke responses to NRC staff requests for additional information (RAI). To determine whether the specific exemptions should be granted, the NRC staff utilized the criteria specified in the *Review Plan for Evaluating the Physical Security Protection Measures Needed for Mixed Oxide Fuel and Its Use in Commercial Nuclear Power Reactors*, dated January 29, 2004. The NRC staff review was consistent with the Commission Memorandum and Order, CLI-04-06, dated February 18, 2004. The NRC staff assumed as a baseline that the Catawba facility will comply with all applicable general security requirements, both those prescribed in NRC rules and those prescribed by NRC order. Specifically, the NRC staff reviewed the appropriate heightening of security measures necessitated by the proposed presence of MOX LTAs at the Catawba Nuclear Power Station.

The underlying purpose of 10 CFR Part 11 is to establish the requirement for access authorization. Part 11 requires licensees possessing a formula quantity of SNM that is subject to the requirements of 10 CFR Part 73 to identify personnel requiring NRC-U or NRC-R access authorizations. A formula quantity of SSNM, as defined in 10 CFR Part 73, includes MOX LTA fuel. An exemption is provided by 10 CFR 73.6, in part, from Sections 73.45 and 73.46 for the categories of material defined therein, which include conventional LEU fuel (enriched to less than 20 percent in U-235). Accordingly, the licensee is not subject to the requirements of 10 CFR 11.11 for the use of LEU fuel. However, since there is no comparable exclusion in Section 73.6 for fuel initially containing a small concentration of plutonium, the requirements of

10 CFR 11.11 become applicable to the licensee for the use of MOX, unless an exemption is granted pursuant to 10 CFR 11.9.

The NRC staff has found that the MOX material, while technically meeting the criteria of a formula quantity, is not attractive to potential adversaries from a proliferation standpoint due to its low Pu concentration, composition, and form (size and weight). The MOX fuel consists of Pu oxide particles dispersed in a ceramic matrix of depleted uranium oxide with a Pu concentration of less than six weight percent. The MOX LTAs will consist of conventional fuel assemblies designed for a commercial light-water power reactor that are over 12 feet long and weigh approximately 1500 pounds. On these bases, the NRC staff finds that the complete application of 10 CFR 11.11 is not necessary, and the exemption is authorized by law and will not constitute an undue risk to the common defense and security. Accordingly, pursuant to 10 CFR 11.9, based upon the physical characteristics of the MOX LTAs and the proposed additional protective measures, the NRC staff concludes that it is acceptable to grant an exemption from the requirements of 10 CFR 11.11(a)(1) - (a)(2), and 11.11(b).

The underlying purpose of 10 CFR Part 73 is to prescribe requirements for the establishment and maintenance of a physical protection system that will have capabilities for the protection of SSNM at fixed sites and in transit. As noted above, an exemption is provided by Section 73.6 for the licensee in its use of conventional LEU fuel enriched to less than 20 percent U-235, but not for fresh MOX fuel containing Pu. The NRC staff found that the MOX material, while technically meeting the criteria of a formula quantity, is not attractive to potential adversaries from a proliferation standpoint due to its low Pu concentration, composition, and form (size and weight). The MOX fuel consists of Pu oxide particles dispersed in a ceramic matrix of depleted uranium oxide with a Pu concentration of less than six weight percent. The MOX LTAs will consist of conventional fuel assemblies designed for a commercial light-water power reactor that are over 12 feet long and weigh approximately 1500 pounds. A large

quantity of MOX fuel and an elaborate extraction process would be required to yield enough material for use in an improvised nuclear device or weapon. On these bases, the NRC staff finds that the complete application of 10 CFR 73.45(d)(1)(iv), 73.46 (c)(1), 73.46(h)(3), 73.46(b)(3) - (b)(12), 73.46(d)(9), and 73.46(e)(3) for MOX fuel is not necessary and that the exemptions are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

Accordingly, based on the physical characteristics of the MOX LTAs and the proposed additional protective measures, the NRC staff, pursuant to 10 CFR 73.5, concludes that it is acceptable to grant an exemption from these portions of 10 CFR Part 73.

6.0 CONCLUSION FOR PART 11 AND PART 73 EXEMPTIONS

For the reasons set forth above, the Commission has determined that, pursuant to 10 CFR 11.9, the requested exemptions are authorized by law and will not constitute an undue risk to the common defense and security. In addition, pursuant to 10 CFR 73.5, the exemptions are authorized by law, will not endanger life or property or the common defense and security, and are otherwise in the public interest. Therefore, the Commission hereby grants Duke Energy Corporation the requested exemptions from the requirements of 10 CFR 11.11(a)(1) - (a)(2), 10 CFR 11.11(b), and 10 CFR 73.45(d)(1)(iv), 73.46 (c)(1), 73.46(h)(3), 73.46(b)(3) - (b)(12), 73.46(d)(9), and 73.46(e)(3).

7.0 ENVIRONMENTAL EVALUATION

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment (69 FR 51112 and 70 FR 8849).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 3rd day of March 2005.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Ledyard B. Marsh, Director
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cc: w/o Enclosure 2

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